

WHAT IS CLAIMED IS:

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1. A liquid substance supply device that supplies a liquid substance, which comprises a liquid organometal or an organometal solution and is stored in a substance container, via a liquid substance transfer line to a vaporizer, comprising:

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a three port two valve directional control valve that is of unitary structure and comprises a first valve body which is provided between a first conduit and a second conduit and performs an ON-OFF control of transfer of fluid between said first conduit and said second conduit and a second valve body which is provided between said second conduit and a third conduit and performs an ON-OFF control of transfer of fluid between said second conduit and said third conduit, said second conduit being provided between said first valve body and said second valve body, wherein

said three port two valve directional control valve is disposed at a branch point where said liquid substance transfer line branches into three directions.

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2. A liquid substance supply device that supplies gas via a gas supply line to a substance container which stores a liquid substance comprising a liquid organometal or an organometal solution, supplies the liquid substance by

pressure of the gas to a liquid substance transfer line, and
supplies the liquid substance to a vaporizer via said liquid
substance transfer line, comprising:

5 a four port three valve directional control valve that
is of unitary structure and comprises a first valve body which
is provided between a first conduit and a second conduit and
performs an ON-OFF control of transfer of fluid between said
first conduit and said second conduit, a second valve body
10 which is provided between said first conduit and a third
conduit and performs an ON-OFF control of transfer of fluid
between said first conduit and said third conduit, and a third
valve body which is provided between said third conduit and
a fourth conduit and performs an ON-OFF control of transfer
15 of fluid between said third conduit and said fourth conduit,
said first conduit being provided between said first valve
body and said second valve body, said third conduit being
provided between said second valve body and said third valve
body, wherein:

20 said four port three valve directional control valve is
provided between said liquid substance transfer and said gas
supply lines and said substance container;

said first conduit and said gas supply line are
connected together;

25 said second conduit and a gas region of said substance
container are connected together;

said third conduit and said liquid substance transfer line are connected together;

said fourth conduit and a liquid region of said substance container are connected together; and

5 said substance container and said four port three valve directional control valve can be attached to and removed from said gas supply line and said liquid substance transfer line as one unit.

10 3. A liquid substance supply device that supplies gas via
a gas supply line to a substance container which stores a
liquid substance comprising a liquid organometal or an
organometal solution, supplies the liquid substance by
pressure of the gas to a liquid substance transfer line, and
15 supplies the liquid substance to a vaporizer via said liquid
substance transfer line, wherein:

said substance container comprises a casing, to which
gas from said gas supply line is supplied, and an inner bag
which is flexible or bellows-shaped, is housed within said
20 casing, and contains the liquid substance; and

when the gas is supplied to within said casing, the
liquid substance in said inner bag is expelled from said
substance container towards said liquid substance transfer
line.

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4. A liquid substance supply device according to Claim 3,
further comprising:

a measurement means that measures an amount of liquid
substance in said inner bag based upon variation of pressure
5 of the gas supplied to within said casing.

Fig 2b
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10 5. A liquid substance supply device that supplies gas via
a gas supply line to a substance container which stores a
liquid substance comprising a liquid organometal or an
organometal solution, supplies the liquid substance by
pressure of the gas to a liquid substance transfer line, and
supplies the liquid substance to a vaporizer via said liquid
substance transfer line, comprising:

15 a first bellows-shaped bag into which the liquid
substance is charged;

a second bellows-shaped bag which is connected to said
first bellows-shaped bag in series in an expansion and
contraction direction of said first bellows-shaped bag, and
contracts said first bellows-shaped bag by gas supply from
20 said gas supply line; and

an indication member which is provided to a connection
portion between said first bellows-shaped bag and said second
bellows-shaped bag and indicates a position of said
connection portion, wherein

25 when said first bellows-shaped bag is contracted by

said second bellows-shaped bag, the liquid substance within said first bellows-shaped bag is expelled towards said liquid substance transfer line.

- 5 6. A liquid substance supply device according to Claim 1, further comprising:

10 a drain tank whose interior is evacuated to a low pressure state, which receives waste fluid which is exhausted when liquid substitution or conduit rinsing is being performed in said liquid substance transfer line, and which is connected via a valve to said liquid substance transfer line directly before said vaporizer.

- 15 7. A liquid substance supply device according to Claim 2, further comprising:

20 a drain tank whose interior is evacuated to a low pressure state, which receives waste fluid which is exhausted when liquid substitution or conduit rinsing is being performed in said liquid substance transfer line, and which is connected via a valve to said liquid substance transfer line directly before said vaporizer.

8. A liquid substance supply device according to Claim 3, further comprising:

25 a drain tank whose interior is evacuated to a low

pressure state, which receives waste fluid which is exhausted when liquid substitution or conduit rinsing is being performed in said liquid substance transfer line, and which is connected via a valve to said liquid substance transfer
5 line directly before said vaporizer.

9. A liquid substance supply device according to Claim 4, further comprising:

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10 a drain tank whose interior is evacuated to a low pressure state, which receives waste fluid which is exhausted when liquid substitution or conduit rinsing is being performed in said liquid substance transfer line, and which is connected via a valve to said liquid substance transfer line directly before said vaporizer.

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10. A liquid substance supply device according to Claim 1, further comprising:

20 a detection device that is provided at said liquid substance transfer line, and detects a presence or absence of the liquid substance in said liquid substance transfer line, or a presence or absence of bubbles generated from the liquid substance by using a photoelectric sensor.

11. A liquid substance supply device according to Claim 2,
25 further comprising:

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a detection device that is provided at said liquid substance transfer line, and detects a presence or absence of the liquid substance in said liquid substance transfer line, or a presence or absence of bubbles generated from the liquid substance by using a photoelectric sensor.

12. A liquid substance supply device according to Claim 3, further comprising:

a detection device that is provided at said liquid substance transfer line, and detects a presence or absence of the liquid substance in said liquid substance transfer line, or a presence or absence of bubbles generated from the liquid substance by using a photoelectric sensor.

13. A liquid substance supply device according to Claim 4, further comprising:

a detection device that is provided at said liquid substance transfer line, and detects a presence or absence of the liquid substance in said liquid substance transfer line, or a presence or absence of bubbles generated from the liquid substance by using a photoelectric sensor.

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14. A liquid substance supply device that supplies a liquid substance which is stored in a substance container via a liquid substance transfer line to a vaporizer at a flow rate

which is controlled by a flow rate control device which comprises a thermal mass flow rate meter which utilizes heat radiation from a heating element and a flow rate control valve, wherein

5 said flow rate meter and said flow rate control valve are separated from one another, said flow rate meter being disposed on a side of said liquid substance transfer line towards said substance container, and said flow rate control valve being disposed on a side of said liquid substance
10 transfer line towards said vaporizer.

15. A liquid substance supply device according to Claim 14, wherein:

 said flow rate control valve comprises a cutoff
15 mechanism which can cut off a supply of the liquid substance.

16. A liquid substance supply device according to Claim 1, wherein

 one of PEEK (polyether ether ketone), PTFE
20 (polytetrafluoroethylene), PI (polyimide), and PBI (polybenzimidazole) is used as a material for making a resin member which is provided in said liquid substance transfer line and contacts the liquid substance.

25 17. A liquid substance supply device that supplies a liquid

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substance, which is stored in a substance container, via a liquid substance transfer line to a vaporizer, comprising:

a filter provided in said liquid substance transfer line which comprises a plurality of layers of a first mesh made of stainless steel (SUS) which has a fine wire diameter and a plurality of layers of a second mesh made of stainless steel (SUS) which has a coarse wire diameter.

18. A liquid substance supply device according to Claim 17, wherein

PTFE mesh is employed ¹¹²⁽⁴⁾ instead of said stainless steel (SUS) mesh.

15 19. ¹⁵⁻²⁵ A vaporizer ^{intended use} (that supplies a vaporized liquid substance to a CVD film deposition device), comprising:

^{392/399?} ¹²²⁺ — an atomization section which sprays a gas/liquid mixture substance consisting of a mixture of a liquid substance which comprises a liquid organometal or an organometal solution and a carrier gas, from an end portion of a transfer conduit; and

— a vaporization section which vaporizes said sprayed liquid substance, wherein:

said transfer conduit is made as a double conduit comprising an internal conduit in which the liquid substance is transferred as a gas/liquid two phase flow and an external

conduit into which said internal conduit is inserted keeping
a space therebetween and which transfers gas for atomization;
and

an orifice member, in which an aperture portion is
5 formed into which said internal conduit is inserted keeping
a gap therebetween and the gas for atomization which has been
transferred by said external conduit is spouted into said
vaporization section through said gap, is provided at an end
portion of said internal conduit.

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20. A vaporizer according to Claim 19, further comprising:

a nozzle ring which is provided at a tip of said
atomization section in a vicinity of said end portion of said
internal conduit, and upon which a vaporization surface is
15 formed which prevents the liquid substance which has been
vaporized from re-condensing, wherein

said orifice member is made from PEEK (polyether ether
ketone) and is sandwiched between said nozzle ring and a tip
of said external conduit, and a seal member made from PTFE
20 (polytetrafluoroethylene) is disposed between said orifice
member and said tip of said external conduit.

21. A vaporizer according to Claim 20, wherein

said nozzle ring comprises a first member which is
25 engaged with the tip of said atomization section by screwing,

and a second member which is provided separately from said first member and is sandwiched between said orifice member and said first member.

5 22. A vaporizer according to Claim 19, further comprising:

10 a nozzle ring which is fixed to said vaporization section in a vicinity of said end portion of said internal conduit, and upon which a vaporization surface is formed which prevents the liquid substance which has been vaporized from re-condensing, wherein

15 said orifice member is made from PEEK (polyether ether ketone) and is sandwiched between said nozzle ring and a tip of said external conduit, and a seal member made from PTFE (polytetrafluoroethylene) is disposed between said orifice member and said tip of said external conduit.

23. A vaporizer according to Claim 19, further comprising:

20 as a coupling which fixes said internal conduit to said atomization section, a gasket type seal coupling which comprises a metal gasket and a pair of coupling members which are provided so as to sandwich said metal gasket between them, wherein

25 one of said pair of coupling members is fixed to said atomization section while the other of said pair of coupling members is fixed to said internal conduit, and an amount of

projection of the end portion of said internal conduit from said orifice member can be adjusted by adjusting an amount of screwing in an axial direction of said gasket type seal coupling.

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24. A vaporizer ^{intended use} (that supplies a vaporized liquid substance to a CVD film deposition device), comprising:

an atomization section which sprays a gas/liquid mixture substance consisting of a mixture of a liquid substance which comprises a liquid organometal or an organometal solution and a carrier gas, from an end portion of a transfer conduit; and

a vaporization section which vaporizes said sprayed liquid substance, wherein

the liquid substance flows through said transfer conduit in an annular spray flow state.

25. A vaporizer in which a liquid substance which comprises a liquid organometal or an organometal solution is sprayed into a vaporization chamber which is kept at a high temperature, and which vaporizes the sprayed liquid substance ^{intended use} (and supplies the vaporized liquid substance to a CVD film deposition device), wherein

within said vaporization chamber, a vaporization surface whose temperature can be controlled independently of

a temperature of said vaporization chamber is provided.

26. A vaporizer that sprays a liquid substance which
comprises a plurality of liquid organometals or organometal
5 solutions into a vaporization chamber which is kept at high
temperature, and which vaporizes the sprayed liquid
substances (and ^{intended use} supplies the vaporized liquid substances to
a CVD film deposition device) comprising:

— a plurality of atomization sections which spray liquid
10 substances into said vaporization chamber; and

— a plurality of vaporization surfaces each opposing one
of said plurality of atomization sections, whose temperatures
can be independently controlled.

15 27. A vaporizer according to Claim 25, wherein:

in said vaporization chamber, a tubular chamber is
formed extending in a horizontal direction, a part of an inner
wall surface of said tubular chamber defining said
vaporization surface; and

20 the liquid substance is sprayed in a vertically
downwards direction into said tubular chamber.

28. A vaporizer according to Claim 25, wherein

an inner wall of said vaporization chamber and said
25 vaporization surface are coated with a film of the same

substance as a film which is deposited by said CVD film deposition device.

29. A vaporization performance appraisal method for a vaporizer in which a liquid substance which comprises a liquid organometal or an organometal solution is sprayed into a vaporization chamber which is kept at a high temperature and is vaporized, comprising:

spraying a predetermined amount of the liquid substance into the vaporization chamber and vaporizing the sprayed liquid substance;

removing a non-vaporized adherent material in said vaporization chamber using an organic solvent;

measuring an amount of the liquid substance which is contained in the organic solvent which has been used for this removal; and

appraising a vaporization performance based upon the amount of the contained liquid substance which has been measured.